



Raptor Liner RLB

BS 7976-2 Slip Test Report

Addressee: Alex Blackburn-Elliot

Report carried out on behalf of: U-POL Ltd
Denington Industrial Estate
Denington Road
Wellingborough
Northants
NN8 2QH

Tests conducted at: U-POL Ltd
Denington Industrial Estate
Denington Road
Wellingborough
Northants
NN8 2QH

Test date(s): 16/03/15
Report date: 23/03/15

Report Reference: 1611UPOL210315
Purchase Order: -

Reported results in no way imply that the flooring under test is approved or endorsed by Grip Potential Ltd. Grip Potential Ltd do not give or assume warranty or condition, express or implied, statutory or otherwise, as to condition, quality, performance, merchantability or fitness for the purpose of the test subject and all such warranties and conditions are hereby excluded save to the extent that such exclusion is absolutely prohibited by law. Grip Potential Ltd shall not be liable for any subsequent loss or damage incurred by the client as a result of information contained within this report. Results given herein refer only to areas tested by Grip Potential Ltd.



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Summary

Test Surface	Slider	Slip Risk	
		Dry	Wet
Raptor Liner RLB #1	Slider #96/4S	Low	High
Raptor Liner RLB #2	Slider #96/4S	Low	Low
Raptor Liner RLB #3	Slider #96/4S	Low	Low
Raptor Liner RLB #4	Slider #96/4S	Low	Low
Raptor Liner RLB #5	Slider #96/4S	Low	Low

Results have been classified in accordance with the latest UKSRG Guidelines (Issue 4, 2011) and current UK Health & Safety Executive guidance.



BS 7976-2 Test Certificate

Raptor Liner RLB #1

Site location: In house

Date of test: 16/03/15

Test conducted by: Ben Powers

Image 1. Pendulum tester in-situ



Image 2. Test surface



Pendulum Test Results

Slider #96/4S

Direction	Condition	Pendulum Test Value					Median Values	Slip Risk Classification
Principal	Dry	52	53	53	53	53	53	Low
45°		53	54	54	54	54	54	
90°		56	56	56	56	56	56	
Principal	Wet	22	22	22	22	22	22	High
45°		24	23	23	23	23	23	
90°		29	28	29	28	28	28	

Results generated using a BS 7976 Munro Portable Skid Tester, serial number 0852. The device was calibrated by BSI on 01/04/14, UKAS certificate number 4686. The above results have been classified in accordance with the latest UKSRG Guidelines (Issue 4, 2011) and current UK Health & Safety Executive guidance.

Rz Surface Roughness Results

Direction	Principal	45°	90°	Mean Rz Value (µm)
Rz Value (µm)				n/a

Results not recorded as the surface presents a macro-profile, particulate based profile, or is otherwise unsuitable for measurement with the roughness meter.

Declaration

The above assessment was carried out by Grip Potential adhering to the UKSRG, HSE and CIRIA guidelines on pedestrian slip risk assessment. The results given are accurate representations of data acquired in house and through the client. The results have been interpreted to give slip risk classifications based on parameters recommended by the UKSRG and HSE.

Signed:

Ben Powers, BSc (Hons)
Slip risk consultant
23/03/15



BS 7976-2 Test Certificate

Raptor Liner RLB #2

Site location: In house

Date of test: 16/03/15

Test conducted by: Ben Powers

Image 1. Pendulum tester in-situ



Image 2. Test surface



Pendulum Test Results

Slider #96/4S

Direction	Condition	Pendulum Test Value					Median Values	Slip Risk Classification
Principal	Dry	56	57	57	57	58	57	Low
45°		58	58	58	58	58	58	
90°		58	58	58	58	58	58	
Principal	Wet	42	42	42	42	42	42	Low
45°		42	42	42	42	42	42	
90°		42	42	41	41	41	41	

Results generated using a BS 7976 Munro Portable Skid Tester, serial number 0852. The device was calibrated by BSI on 01/04/14, UKAS certificate number 4686. The above results have been classified in accordance with the latest UKSRG Guidelines (Issue 4, 2011) and current UK Health & Safety Executive guidance.

Rz Surface Roughness Results

Direction	Principal	45°	90°	Mean Rz Value (µm)
Rz Value (µm)				n/a

Results not recorded as the surface presents a macro-profile, particulate based profile, or is otherwise unsuitable for measurement with the roughness meter.

Declaration

The above assessment was carried out by Grip Potential adhering to the UKSRG, HSE and CIRIA guidelines on pedestrian slip risk assessment. The results given are accurate representations of data acquired in house and through the client. The results have been interpreted to give slip risk classifications based on parameters recommended by the UKSRG and HSE.

Signed:

Ben Powers, BSc (Hons)
Slip risk consultant
23/03/15



BS 7976-2 Test Certificate

Raptor Liner RLB #3

Site location: In house

Date of test: 16/03/15

Test conducted by: Ben Powers

Image 1. Pendulum tester in-situ

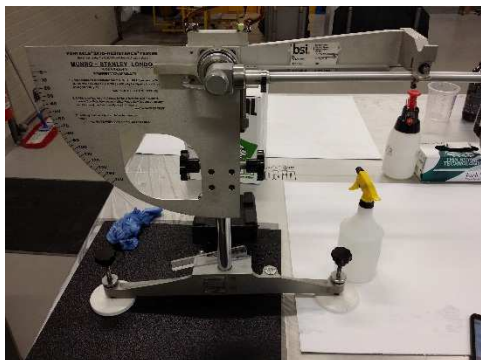


Image 2. Test surface



Pendulum Test Results

Slider #96/4S

Direction	Condition	Pendulum Test Value					Median Values	Slip Risk Classification
Principal	Dry	58	58	58	58	58	58	Low
45°		58	59	59	59	59		
90°		58	58	58	58	58		
Principal	Wet	46	45	45	45	45	45	Low
45°		46	46	46	45	46		
90°		44	44	44	44	44		

Results generated using a BS 7976 Munro Portable Skid Tester, serial number 0852. The device was calibrated by BSI on 01/04/14, UKAS certificate number 4686. The above results have been classified in accordance with the latest UKSRG Guidelines (Issue 4, 2011) and current UK Health & Safety Executive guidance.

Rz Surface Roughness Results

Direction	Principal	45°	90°	Mean Rz Value (µm)
Rz Value (µm)				n/a

Results not recorded as the surface presents a macro-profile, particulate based profile, or is otherwise unsuitable for measurement with the roughness meter.

Declaration

The above assessment was carried out by Grip Potential adhering to the UKSRG, HSE and CIRIA guidelines on pedestrian slip risk assessment. The results given are accurate representations of data acquired in house and through the client. The results have been interpreted to give slip risk classifications based on parameters recommended by the UKSRG and HSE.

Signed:

Ben Powers, BSc (Hons)
Slip risk consultant
23/03/15



BS 7976-2 Test Certificate

Raptor Liner RLB #4

Site location: In house

Date of test: 16/03/15

Test conducted by: Ben Powers

Image 1. Pendulum tester in-situ



Image 2. Test surface



Pendulum Test Results

Slider #96/4S

Direction	Condition	Pendulum Test Value					Median Values	Slip Risk Classification
Principal	Dry	58	58	58	58	58	58	Low
45°		58	58	58	58	58		
90°		58	58	59	59	59		
Principal	Wet	45	45	45	45	45	45	Low
45°		45	45	45	45	45		
90°		46	47	46	46	46		

Results generated using a BS 7976 Munro Portable Skid Tester, serial number 0852. The device was calibrated by BSI on 01/04/14, UKAS certificate number 4686. The above results have been classified in accordance with the latest UKSRG Guidelines (Issue 4, 2011) and current UK Health & Safety Executive guidance.

Rz Surface Roughness Results

Direction	Principal	45°	90°	Mean Rz Value (µm)
Rz Value (µm)				n/a

Results not recorded as the surface presents a macro-profile, particulate based profile, or is otherwise unsuitable for measurement with the roughness meter.

Declaration

The above assessment was carried out by Grip Potential adhering to the UKSRG, HSE and CIRIA guidelines on pedestrian slip risk assessment. The results given are accurate representations of data acquired in house and through the client. The results have been interpreted to give slip risk classifications based on parameters recommended by the UKSRG and HSE.

Signed:

Ben Powers, BSc (Hons)
Slip risk consultant
23/03/15



BS 7976-2 Test Certificate

Raptor Liner RLB #5

Site location: In house

Date of test: 16/03/15

Test conducted by: Ben Powers

Image 1. Pendulum tester in-situ

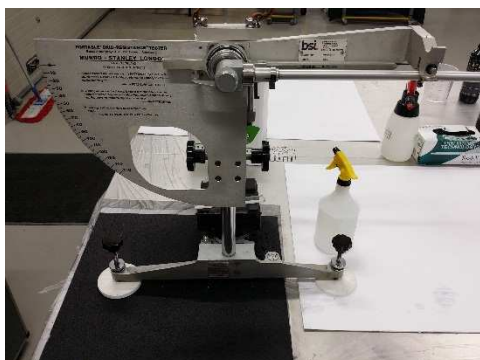


Image 2. Test surface



Pendulum Test Results

Slider #96/4S

Direction	Condition	Pendulum Test Value					Median Values	Slip Risk Classification
Principal	Dry	61	61	61	61	61	61	Low
45°		61	61	61	61	61		
90°		66	66	66	66	66		
Principal	Wet	50	49	49	49	49	50	Low
45°		52	51	51	51	51		
90°		49	50	50	50	50		

Results generated using a BS 7976 Munro Portable Skid Tester, serial number 0852. The device was calibrated by BSI on 01/04/14, UKAS certificate number 4686. The above results have been classified in accordance with the latest UKSRG Guidelines (Issue 4, 2011) and current UK Health & Safety Executive guidance.

Rz Surface Roughness Results

Direction	Principal	45°	90°	Mean Rz Value (µm)
Rz Value (µm)				n/a

Results not recorded as the surface presents a macro-profile, particulate based profile, or is otherwise unsuitable for measurement with the roughness meter.

Declaration

The above assessment was carried out by Grip Potential adhering to the UKSRG, HSE and CIRIA guidelines on pedestrian slip risk assessment. The results given are accurate representations of data acquired in house and through the client. The results have been interpreted to give slip risk classifications based on parameters recommended by the UKSRG and HSE.

Signed:

Ben Powers, BSc (Hons)
Slip risk consultant
23/03/15



Additional Comments

Test Reference

Raptor Liner RLB

Comments

Inclusion of anti-slip particulate in the surface profile shows a significant improvement in wet grip levels in the #2 sample. The risk of a slip occurring on surfaces in excess of 36PTV is very similar, such that a surface presenting a PTV of 50PTV (sample #5) and one at 42PTV (sample #2) present the same slip risk. Consideration should be given to the intended end use as PTV's in excess of 36 will present additional protection against a slip where greater frictional demands are present (pushing/pulling/carrying heavy items, changing direction suddenly, etc). Slip resistance tends to drop over time with wear and as dirt builds up in the surface profile, however the tested surfaces tend to be very resistant to both.




Calibration Records

Records applicable on 16/03/15

Certificate of Test

bsi. For a TRL1 Type Portable Skid-Resistance Tester in accordance with BS 812-114: 1989 and BS 7976-3: 2002



Client: Munro Instruments Limited
Gilbert House
406 Roding Lane South
Woodford Green
Essex
IG8 8EY

Job No: 287/8075078 **Date Received:** 1 April 2014

Serial No: 0852 **Date of Test:** 1 April 2014

Certificate No: 4686

Authority to test: Purchase Order No 1724 dated 28 March 2014

Ambient Conditions: (20 ± 3)°C (50 ± 20)% RH


This Certificate details the results obtained during the test of the above instrument. All measurements were conducted after allowing the instrument to stabilize in the laboratory.

Uncertainties stated are those relating to the measuring equipment used and to the equipment under test. They apply only under the ambient conditions specified above. The uncertainties do not allow for repeatability or reproducibility of the equipment under test and secular change is not taken into account.

The reported expanded uncertainties are based on the standard uncertainties multiplied by a coverage factor *k*=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Periodicity
The instrument should be returned at least once a year for re-evaluation Ref: BS 812-114: 1989 Clause 5.2.2.1, BS EN 1097-8: 2009 Clause 7.3 (Annex D), BS 7976-3: 2002 Clause 4 and BS EN 13036-4: 2003 Clause 7.1.

Notes
The test procedure used to verify this PSRT was No: T.2285.019 in accordance with BS 812-114: 1989 Clause 5.2, BS EN 1097-8 Clause 7.3 and Annex D, BS 7976-3: 2002 and BS EN 13036-4: 2003 Clause 6 and Annex A.2. UKAS accreditation applies to BS 812-114: 1989 Clause 5.2, BS EN 1097-8 Clause 7.3 and Annex D, BS 7976-3: 2002 and BS EN 13036-4: 2003 Clause 6 and Annex A.2.


Authorized by:  **Date:** 2 April 2014

M Mayo
Laboratory Manager
BSI, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ Telephone: +44 (0)845 080 9000

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Certificate of Test

bsi. For a TRL1 Type Portable Skid-Resistance Tester in accordance with BS 812-114: 1989 and BS 7976-3: 2002




Job No: 287/8075078 **Cert No:** 4686 **Date tested:** 1 April 2014

Results	Symbol	Specified	Actual	Uncertainty
Sliding Distance	(D)	Nominal	126 mm	± 0.6 mm
Length of Pointer	(P)	Not specified	302 mm	± 0.65 mm
Mass of Pointer		85 g max	80.1 g	± 0.6 g
Angle of Slider		(26 ± 3)°	23.6°*	± 1°
BS 812-114:1989				
Mass of Swinging Arm	(W [±])	(1.500 ± 0.03) kg	1.511 kg	± 0.0006 kg
Force of Swinging Arm	(W)	Calculated	14.82 N	± 0.009 N
C of G from Centre of Oscillation	(X)	(410 ± 5) mm	410 mm	± 0.9 mm
*F Scale - Vertical Distance	(Z)	10mm Nominal	N/T	± 0.6 mm
Slider Force	(P)	(22.20 ± 0.5) N	22.48 N	± 0.004 N
Change in Slider Force	(N)	0.2 N/mm max	0.13 N/mm	± 0.004 N/mm
BS 7976-3:2002				
Spring Tension Force	(F)	Calculated	22.40 N	± 0.009 N
Actual Spring Tension Force		Not specified	22.46 N	± 0.009 N
Change in Spring Tension Force		± 0.5 N	0.06 N	± 0.009 N
Mass of Slider and base		(35 ± 5) g	35.9 g	± 0.6 g
Sliding edge to axis of suspension		(514 ± 6) mm	512 mm	± 0.9 mm

N/T denotes not tested

* All measured results indicated with an * are below/above the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance/non-compliance with the specification. For this reason this report is issued with results only where applicable. All other results are unaffected by this.


Tested by: 

C. Tearle
Test Engineer
BSI, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ Telephone: +44 (0)845 080 9000

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Certificate of Test

bsi. For a TRL1 Type Portable Skid-Resistance Tester in accordance with BS 812-114: 1989 and BS 7976-3: 2002



Job No: 287/8075078 **Cert No:** 4686 **Date tested:** 1 April 2014

Testing Results **BSI PS Master (Main Scale)** **Clients (Main Scale)**

Serial No's 9931 0852

Pre-calibration validation results

	BS 7976-3: 2002	BS 7976-3: 2002
Zero	N/T	N/T
Glass Surface	N/T	N/T
Pink Lapping Paper	N/T	N/T


Final calibration results

	BS 7976-3: 2002 (4S Slider)	BS 7976-3: 2002 (4S Slider)
Glass Surface	7	8
Pink Lapping Paper	65	65

	BS 812-114: 1989 (TRL Slider)	BS 812-114: 1989 (TRL Slider)
Glass Surface	10	10
Pink Lapping Paper	59	62
Surface 2S	10	11
Surface 3S	53	55
Surface 4S	57	60
Surface 5S	35	35
Surface 7R	52	51
Surface 8R	53	54
Surface 9R	68	68
Surface 10R	71	68
Surface 11R	76	74
Mean Value	49.45	49.82

Largest Difference: 3 (≤ 3) Mean Value Difference: 0.36 (≤ 1.5)

S - Smooth, R - Rough

Tested by: 

C. Tearle
Test Engineer
BSI, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ Telephone: +44 (0)845 080 9000

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Calibration Records

Records applicable on 16/03/15

CERTIFICATE OF CALIBRATION

Issued By **Taylor Hobson Calibration Laboratory**

Issue Date: 06-March-2013 Certificate No: 54219
Date of Calibration: 06-March-2013

0026

Taylor Hobson Limited
2 New Star Road
Leicester, LE4 9JQ
England
Tel: +44 116 2443104
Fax: +44 116 2443058
E-Mail: taylor-hobson.calibration@ametek.com
Internet: http://www.taylor-hobson.com

Page 1 of 2 Pages
APPROVED SIGNATORY
J.D. Leeman

TAYLOR HOBSON

Description:	Roughness Standard
Code Number:	112/2937
Serial Number:	10243
Manufactured by:	Taylor Hobson Ltd
Calibrated For:	Spectrum Metrology Ltd, 8 Ireton Avenue, Leicester LE4 9EU, United Kingdom.

Acting as Agent for:	Grip Potential: NN14 4BX
Customer Order Number:	5443
Taylor Hobson Order Number:	268748

Previous Certificate Number:	Not Applicable
Records Reference:	Network
Calibration Temperature:	20°C ±1°C
Date Received into Laboratory:	05-March-2013

AMETEK
ULTRA PRECISION TECHNOLOGIES

Certified: *[Signature]*

This certificate is issued in accordance with the laboratory accreditation requirements of both the United Kingdom Accreditation Service and ISO 17025. It provides traceability of measurement to recognised national standards, and to units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

CERTIFICATE OF CALIBRATION

UKAS ACCREDITED CALIBRATION LABORATORY 0026

06-March-2013

Serial Number: 54219

Page 2 of 2

This standard has been calibrated using computerised traceable measuring techniques on a Taylor Hobson Form Talysurf instrument. All measurements were taken using a 90° conisphere diamond tip stylus with a nominally 2µm spherical radius. A traversing speed of 0.5mm per second, an X-axis sampling rate of 0.25µm, Z-axis resolution of 3.2nm and software stylus tip/arcuate correction have been applied throughout the measurements.

The measured surface finish data was analysed using a 0.8mm ZDR filter cut-off with a bandwidth ratio of 100:1, the mean Ra and Rz results, rounded to the nearest 0.01µm, are shown in Tables 1 and 2.

The uncertainty of calibration for amplitude parameters is ±1%+0.004µm of the mean value. When added to the standard deviation of the measurements, this gives a maximum uncertainty of calibration as stated in Tables 1 & 2.

Included in the tabulated results is a calculated imperial equivalent.

Table 1		
Mean Ra Value	Standard Deviation	Maximum Uncertainty
5.79µm	0.020µm	±0.140µm
228µin	0.8µin	±5.5µin

Table 2		
Mean Rz Value	Standard Deviation	Maximum Uncertainty
21.40µm	0.085µm	±0.517µm
842µin	3.3µin	±20.3µin

Upon receipt into the laboratory the standard was marked:

Ra	5.81µm
	229µin
Rz	21.50µm
	847µin

Certified: *[Signature]*

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Calibration Records - Pendulum Rubber Sliders

Date: 7th May 2014

Your Ref.: Ben Power

Our Ref.: 1916

MUNRO
INSTRUMENTS

Grip Potential Ltd
Ringstead Business Centre
1-3 Spencer Street
Ringstead
Northants
NN14 4BX

Certificate of Conformity for Four S Rubber

Description and Part Number	Qty	Specification
881032/2 - Mounted Four S Rubber (96) Slider - Large - for Main Tester. Batch No. 352	10	Hardness : BS ISO 48:2010 Lupke Resilience : BS ISO 4662:2009
Temperature :	5°C	23°C 40°C
Resilience % (limits)	19-24	22 - 26 26 - 30
Resilience % (mean results)	21	26 26

Hardness was determined at a temperature of 23 ± 2°C. Five readings were taken on the test pieces and a value of 95 was obtained. This falls within the specified limit of 96±2

Resilience was determined at the specified temperature in accordance with BS ISO 4662:2009 The Lupke resilience was within the specified limits.

The Four S rubber supplied, Batch Number 352, conforms to the test specifications laid down by the UK Slip Resistance Group.

Recommended date of disposal: 07.05.2015

Certified that the whole of the supplies detailed above have been inspected, tested and unless otherwise stated, conform in all respects with the requirements of the contract or order.

Signed: *[Signature]*

Date of issue: 07.05.2014

Munro Instruments Ltd, Gibson Spring Lane South, Woodford Green, Essex, IG8 8EY UK
P: +44 (0) 20 8551 7000 / F: +44 (0) 20 8551 4565 / E: info@munroinstruments.co.uk / www.munroinstruments.co.uk
Company Registration Number: 06965050 VAT Number: GB 977 7939 30

Date: 7th May 2014

Your Ref: Ben Powers

Our Ref.: 1966

MUNRO
INSTRUMENTS

Grip Potential
Ringstead Business Centre
1-3 Spencer Street
Ringstead
Northants
NN14 4BX

Certificate of Conformity for TRL (55) Rubber

Description and Part Number	Qty	Specification
881032/1 - Mounted TRL Rubber (55) Slider - Large - for Main Tester. Batch No. 397	5	Hardness : BS ISO 48:2010 Lupke Resilience : BS ISO 4662:2009
Temperature :	0°C	10°C 20°C 30°C 40°C
Hardness IRHD	54	54 54 54 54 54
Resilience % (limits)	43-49	58-65 66-73 71-77 74-79
Resilience % (mean results)	47	61 67 71 74

The hardness, at all the specified temperatures, was within the specified limit of 55 ± 5 IRHD.

The Lupke resilience was within the specified limits.

The TRL rubber supplied, Batch Number 397, conforms to the test specifications laid down by the UK Slip Resistance Group.

Recommended date of disposal: 07.05.2015

Certified that the whole of the supplies detailed above have been inspected, tested and unless otherwise stated, conform in all respects with the requirements of the contract or order.

Signed: *[Signature]*

Date of issue: 07.05.2015

Munro Instruments Ltd, Gibson Spring Lane South, Woodford Green, Essex, IG8 8EY UK
P: +44 (0) 20 8551 7000 / F: +44 (0) 20 8551 4565 / E: info@munroinstruments.co.uk / www.munroinstruments.co.uk
Company Registration Number: 06965050 VAT Number: GB 977 7939 30



Theory

Research carried out by the Health and Safety Laboratory, in conjunction with the UK Slip Resistance Group (UKSRG), has shown that it is possible to assess the characteristics of floor surface materials needed for satisfactory slip resistance. The UKSRG, in partnership with several major laboratories including the Health and Safety Laboratory, has developed a "reliable and robust" test method that forms the basis of Grip Potential's assessment procedure.

The BS 7976-2 pendulum slip test forms the basis of the coefficient of dynamic friction measurement of a floor. A calibrated 'foot' swings from a horizontal point of release, strikes the test surface for a known distance, then reads the "Pendulum Test Value" (PTV) on its overswing. The rubber slider that contacts the floor is constructed of '4S' rubber (Standard Simulated Shoe Sole) and is designed to replicate the most common slipping motion experienced by pedestrians wearing shoes. A softer, more malleable, rubber (TRL rubber) can be used to simulate a barefoot or soft soled shoe slip. Pendulum testing is one of the few methods that accurately models the formation of a hydrodynamic squeeze film between the floor and shoe sole, a major factor in a wet slip.

A surface roughness meter is used to predict the ability of the floor's surface to puncture the hydrodynamic squeeze film. The film forms a barrier between sole and floor and significantly reduces grip, in a similar way that a car tyre aquaplanes. The HSE recommend a minimum Rz value of 20µm for a surface subject to water contamination. A thicker contaminant, such as motor oil, will require a greater surface roughness in order to facilitate a sole-floor contact. For this reason it is important to take into account expected contaminants when specifying a floor surface. In our extensive experience conducting BS 7976-2 pendulum tests alongside Rz surface roughness measurements we have not found a reliable correlation between pendulum and Rz values. On this basis Rz values are included in our assessments to provide additional information about test surfaces only, pendulum test values should be considered the overriding measurement of slip resistance in dry and water wet conditions.

A site assessment is an important component in determining the slip risk of any given floor. The HSE's pedestrian Slips Potential Model highlights important environmental factors in a slip. Contaminating substances, frequency and methods of cleaning, types of footwear and likely pedestrian behaviour all affect the potential for a slip incident and are given due consideration when interpreting PTV's and fitness for purpose of the test surface.

BS 7976-2:2002 - Pendulum Testers, Method of Operation

Coefficient of dynamic friction measurement is carried out in accordance with BS 7976-2 and the UKSRG Guidelines 2011. These industry standard methods of testing are essentially the same but with a slight difference between the two methods of preparation of the rubber sliders. Testing has been carried out in accordance with the UKSRG Guidelines 2011 as both the HSE and UKSRG agree that this is best practice.

A prepared standard rubber slider attached to a weighted 'shoe' is allowed to swing from a horizontal point of release. The slider is mounted on a spring loaded bracket and makes contact with the floor for a known distance, applying a calibrated force. The height to which the shoe travels after contacting the floor gives a reading of the Pendulum Test Value (PTV, formally known as SRV Slip Resistance Value). The dynamic coefficient of friction of a test surface has a direct and measurable effect on the PTV reading obtained.

Test surfaces are subject to eight measurements of the PTV with the first three being discounted from calculations of the median. Tests are carried out in the principal direction, at 45° to the principal direction and at 90° to the principal direction. Each direction is tested under both wet and dry conditions, totalling 48 measurements. A median value is generated for wet and dry tests based on the performance in different directions, though consideration should be given to surfaces with a directional finish. Surfaces may be subject to 'indicative' testing conducted in a single direction only, typically this method of assessment is used when the directionality of the test surface is either already known or of no interest. Additional contaminants may be used as appropriate to the environment.



A slip potential classification be applied using the following table from the UKSRG Guidelines.

PTV	Slip Potential
<25	High
25-35	Moderate
>35	Low

The law requires provision of a safe environment and that slip risks must be controlled, though there is no requirement for all surfaces present within an area of responsibility to achieve a >35PTV in dry and water wet conditions. It is the opinion of Grip Potential Ltd that surfaces must present a low risk of slip (>35PTV) in the conditions of end use if responsible parties are to demonstrate they have complied with their duty of care in terms of slip resistance. In our experience of slip accident investigations, and subsequent involvement in personal injury cases, surfaces producing anything other than a low risk of slip classification in the conditions of the accident typically result in settlement in the claimant's favour. Of course it should be noted that a wide range of factors can contribute to a slip accident, slips may still occur on surfaces producing values comfortably in excess of 36PTV.

An alternative measure of flooring slip resistance is its coefficient of dynamic friction (CoDF). PTV can be converted to CoDF using the formula below. It should be noted, however, that CoDF describes an interaction between two specific surfaces. This relationship is further complicated by the nature and behaviour of any lubricating film between the two surfaces. A CoDF value for a floor surface is likely to vary dependent on the method used to obtain it and should not be used to convert slip resistance ratings between test methods.

$$\text{CoDF} = (3 \times \text{PTV}) / (330 - \text{PTV})$$

The pendulum skid tester is one of the few test methods that accurately models the hydrodynamic squeeze film formed in a contaminated slip and as experienced by pedestrians. This should be taken into consideration when comparing CoDF values for contaminated surfaces from other test methods.

Surface Roughness Measurement (Rz)

Surface roughness, in particular the Rz value, describes the mean vertical peak to valley distance over a given horizontal sample. The microscopic construction of a surface affects its ability to puncture the fluid film generated in a slip. An Rz meter is a valuable tool to assess changes in a surface over time, as a result of wear, contamination, cleaning or other factors affecting the surface at a microscopic level.

Grip Potential use a Surtronic Duo surface roughness meter for assessment. The meter moves a stylus along the test surface, measuring the floor profile's average vertical peak to valley distance in microns. A test site will be measured ten times using this method, with samples taken in the principal direction, at 45° to the principal direction and at 90° to the principal direction. This is in line with UKSRG guidance.

Surface roughness is often used in isolation to give a general indication of the slip risk potential of a floor, this can result in erroneous classifications of surfaces, possibly exposing pedestrians to an undue risk of slip. Grip Potential Ltd do not use Rz measurements to determine the slip resistance of floor surfaces, nor do we recommend Rz values are used to determine the slip resistance of floor surfaces. Grip Potential use surface roughness measurements married to pendulum results to enable accurate ongoing monitoring of the surface. The UKSRG published the data shown in the table below to use in conjunction with pendulum testing.

Rz	Slip Potential
<10µm	High
10-20µm	Moderate
>20µm	Low



The UKSRG Guidelines 2011 state that, "Microroughness measurements should be used in conjunction with pendulum test values wherever possible. One should not confuse roughness measurements with slip resistance measurements." Limitations of the Rz measurement are that it does not take into account the density, shape or deformation of micro-profile, all of which are factors affecting the dispersal of a fluid film and contact between sole and floor in contaminated conditions. The stylus measuring peak to valley height may travel around anti-slip particulate or may be too wide to measure the depth of narrow valleys, in addition the Rz parameter does not take into account the effect of a macro-profile on fluid film behaviour. In our experience it is common for surfaces to have mismatching pendulum test vs roughness measurement slip resistance classifications.

Where pendulum testing is impossible, Rz measurements married to a similar nearby surface is sometimes the only way to relate a PTV, as recognised by the UKSRG guidelines. This is based on a linear approximation of the relationship between Rz and PTV and is to be considered as a guide only.

Site Assessment

A site assessment is designed to highlight factors that have an impact on slip risk potential. The Grip Potential site assessment follows the pedestrian slip risk potential model as developed by the HSE alongside guidance published by the UKSRG and CIRIA and our own expert knowledge and experience.

A Grip Potential site assessment aims to provide the client with all necessary information of the factors contributing to slip risk of the tested areas. Drawing assessment criteria from a wide range of expert sources ensures that a complete and thorough report of slip risk is produced. Knowledge of factors adversely affecting slip risk allows intelligent decision making in ongoing health and safety procedures.

Our site assessment regime broadly covers the following factors;

- Surface composition and condition, construction and wear.
- Contamination, likely types, sources, levels and effects.
- Footwear, control, expected soles and their effects.
- Cleaning regime, effectiveness, risk of any wet processes.
- Surface usage, moving heavy loads, running, turning, high risk user groups.
- Environmental factors, lighting, distractions, weather etc.

This is in line with the Health and Safety Laboratory developed 'Slips Potential Model' considered to give the most accurate assessment of factors affecting slip risk.

Depending on the function of the report as an accident investigation, standard risk assessment or product certification the site assessment will focus on appropriate factors. An accident investigation will seek to highlight all factors contributing to a particular slip, where a risk assessment will highlight factors that should be considered in the effective ongoing management of the surface.

Information required to complete the site assessment is gathered primarily at the time and location of the test and is based on observations made by the test operator. Information not readily available from a site inspection, such as cleaning regimes, footwear control measures, work controls/processes, is supplied by the person responsible for the site, or a representative of that person. Where information is uncertain, or an assumption is made, we endeavour to make it clear that this is the case.



Personnel Competency

Test Operator(s)

Operator 1

Ben Powers

Relevant Competencies

BS 7976-2
BS EN 13036-4
UKSRG Guidelines
Rz measurement
Slip risk assessment

Requiring Supervision

None

Relevant Qualifications

BSc (Hons) Computational Physics
A-level Maths, Physics
AS-level Chemistry
GCSE Maths, Science

Relevant Experience

>5 years as Slip Risk Consultant
(Grip Potential Ltd)
18 months as Floorcoverings Technician
(SATRA Technology Centre)

Memberships

UK Slip Resistance Group

Additional Notes

Slip tests conducted personally on a daily basis for a wide range of clients across a wide range of environments. Test reports utilised to demonstrate compliance, as part of ongoing risk assessment, to identify and prevent slippery surfaces, as evidence in personal injury cases. Tests regularly conducted alongside established laboratories as part of research conducted by the UK Slip Resistance Group. Reports given in evidence unsuccessfully challenged by opposing expert witnesses of considerable experience in the field of slip resistance. Previously held the position of Laboratory Technician at a reputable test laboratory, working within the floorcoverings team. A large percentage of time was spent conducting slip tests and assessments to a range of standards including BS 7976-2. BS 7976-2 tests were conducted extensively on and off site

Operator 2

n/a

Relevant Competencies

Relevant Qualifications

Relevant Experience

Requiring Supervision

Memberships

Report Author

Name

Ben Powers

Relevant Competencies

BS 7976-2
BS EN 13036-4
UKSRG Guidelines
Rz measurement
Slip risk assessment

Requiring Supervision

None

Relevant Qualifications

BSc (Hons) Computational Physics
A-level Maths, Physics
AS-level Chemistry
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Relevant Experience

>5 years as Slip Risk Consultant
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